

Abstract Title

Solar Cycle Fine Structure and Surface Rotation from Ca II K-Line Time Series Data

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Abstract Body

Analysis of three and a half decades of data from the NSO/AFRL/Sac Peak K-line monitoring program yields evidence for four components to the variation: (a) the solar cycle, with considerable fine structure and a quasi-periodicity of 122.4 days; (b) a stochastic process, faster than (a) and largely independent of it, (c) a quasi-periodic signal due to rotational modulation, and of course (d) observational errors (shown to be quite small). Correlation and power spectrum analyses elucidate periodic and aperiodic variation of these chromospheric parameters. Time-frequency analysis is especially useful for extracting information about differential rotation, and in particular elucidates the connection between its behavior and fine structure of the solar cycle on approximately one-year time scales. These results further suggest that similar analyses will be useful at detecting and characterizing differential rotation in stars from stellar light-curves such as those being produced by NASA's Kepler observatory. Component (b) consists of variations over a range of timescales, in the manner of a "1/f" random process. A time-dependent Wilson-Bappu effect appears to be present in the solar cycle variations (a), but not in the stochastic process (b). The data can be found at the National Solar Observatory web site http://nsosp.nso.edu/data/cak_mon.html, or by file transfer protocol at <ftp://ftp.nso.edu/idl/cak.parameters>.